US009303821B2

(12) **United States Patent**
Lin et al.

(10) **Patent No.: US 9,303,821 B2**
(45) **Date of Patent: Apr. 5, 2016**

(54) **AIR-COOLED LED LAMP BULB**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 339 days.

(21) Appl. No.: **13/919,486**

(22) Filed: **Jun. 17, 2013**

(65) **Prior Publication Data**

US 2014/0293623 A1 Oct. 2, 2014

Related U.S. Application Data

(63) Continuation-in-part of application No. 13/853,647, filed on Mar. 29, 2013, now Pat. No. 9,068,732.

(51) **Int. Cl.**

F21V 29/00	(2015.01)
F21K 99/00	(2010.01)
F21V 29/83	(2015.01)
F21Y 101/02	(2006.01)

(52) **U.S. Cl.**

CPC . ***F21K 9/13*** (2013.01); ***F21V 29/83*** (2015.01); *F21Y 2101/02* (2013.01)

(58) **Field of Classification Search**

CPC ... F21V 29/002; F21V 29/004; F21V 29/503; F21V 29/70; F21Y 2111/001; F21Y 2111/004; F21Y 2111/0076

USPC 362/650, 240, 249.02, 294, 373

See application file for complete search history.

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(57) **ABSTRACT**

An air-cooled lamp bulb includes a central tube and a circular light wall. The circular light wall is formed by a plurality of light units surrounding the central tube and emitting light beams in a direction away from the central tube. A top frame supports the circular light wall on top. A top opening is formed in the top frame. A bottom gap is formed between a bottom of the central tube and a bottom of the circular light wall. An air passage is formed between the central tube and the circular light wall. The air passage connects the top opening and the bottom gap for allowing air flow through the air-cooled lamp bulb.

13 Claims, 18 Drawing Sheets

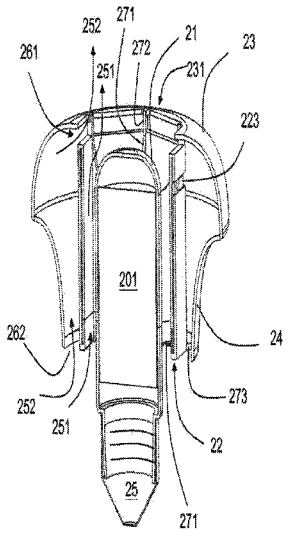


Fig.1 Prior Art

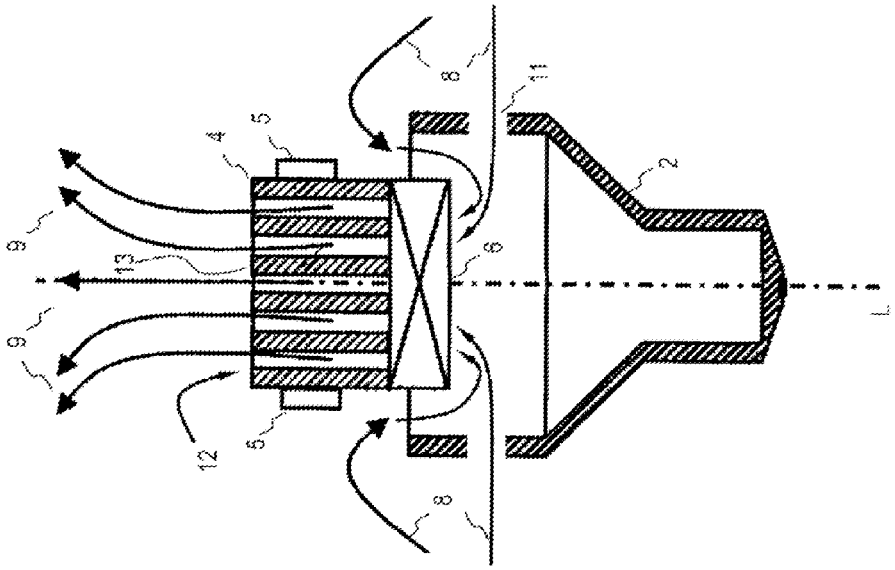


Fig.2

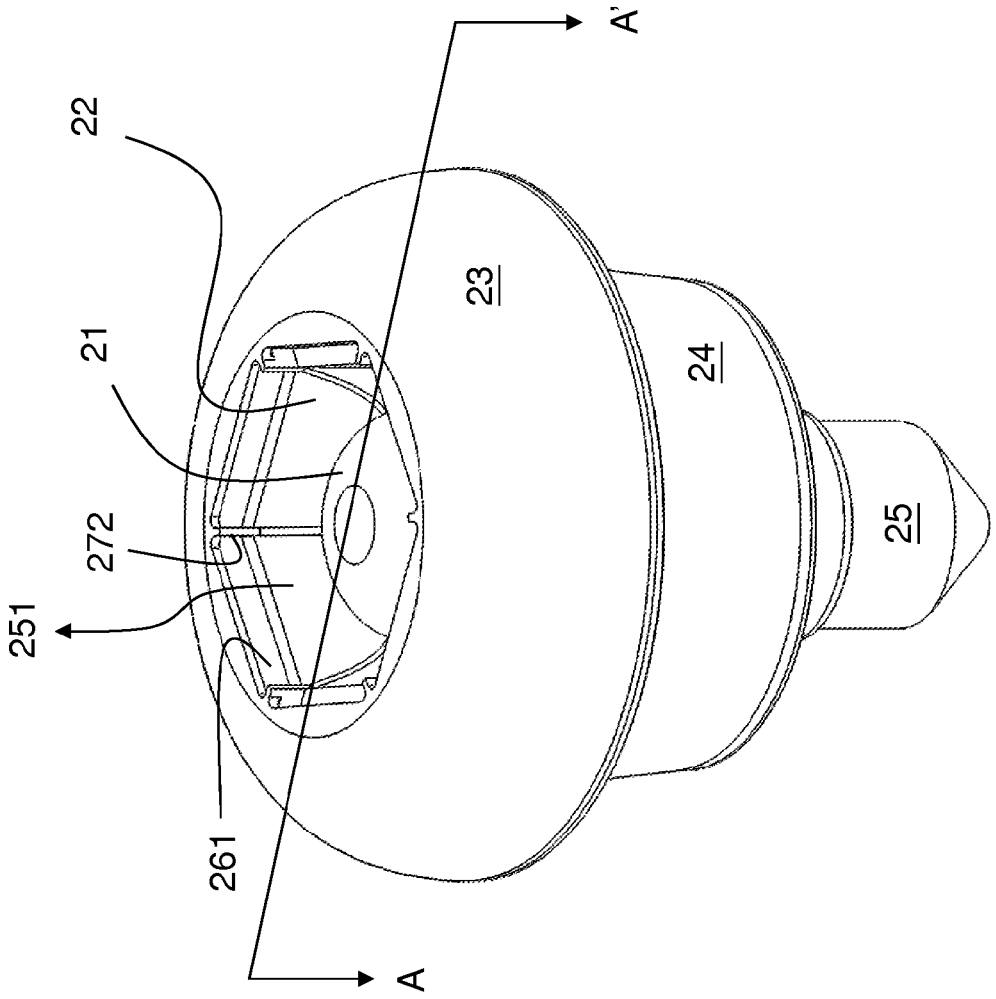


Fig.3A

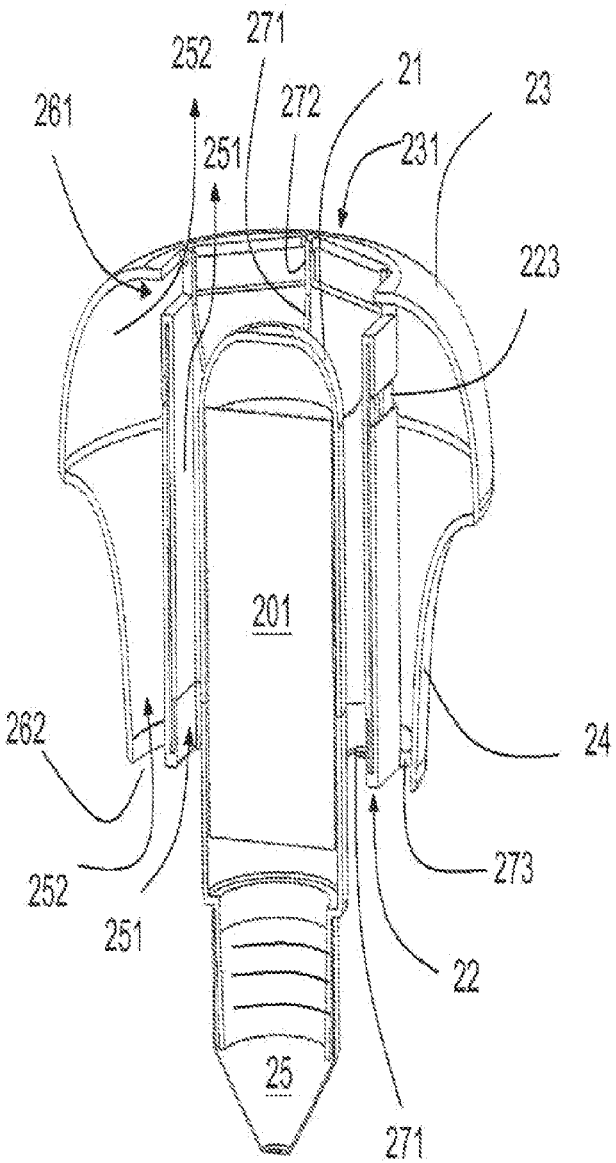


Fig.3B

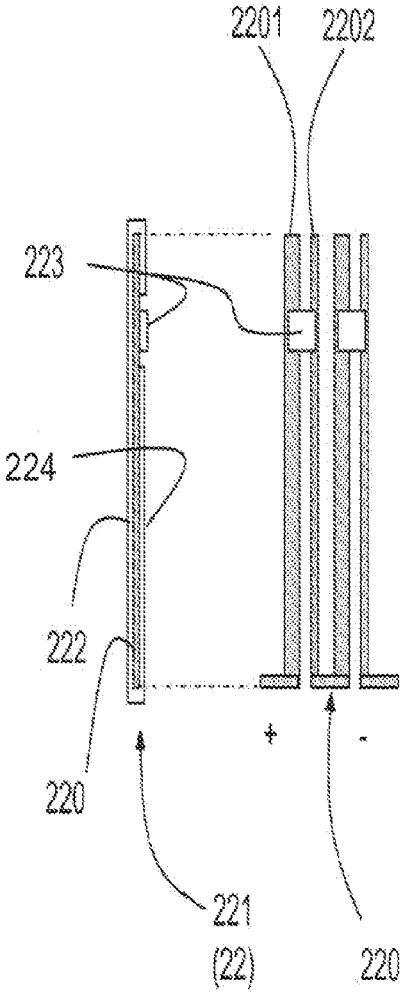


Fig.3C

Fig.4

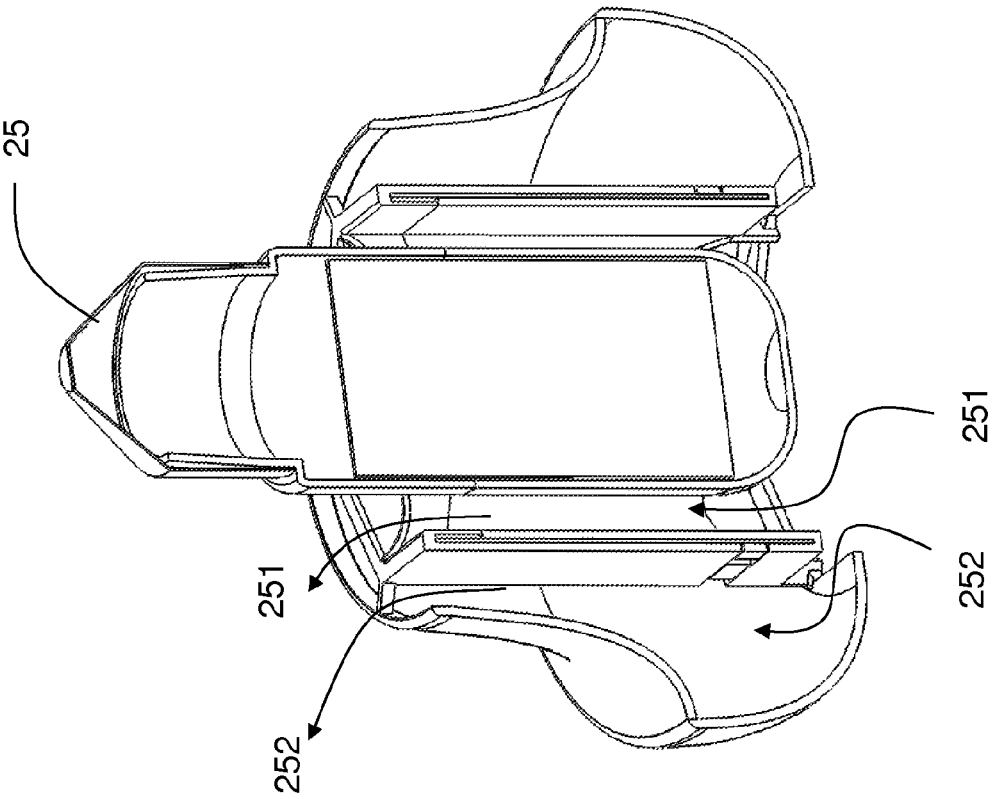


Fig.5

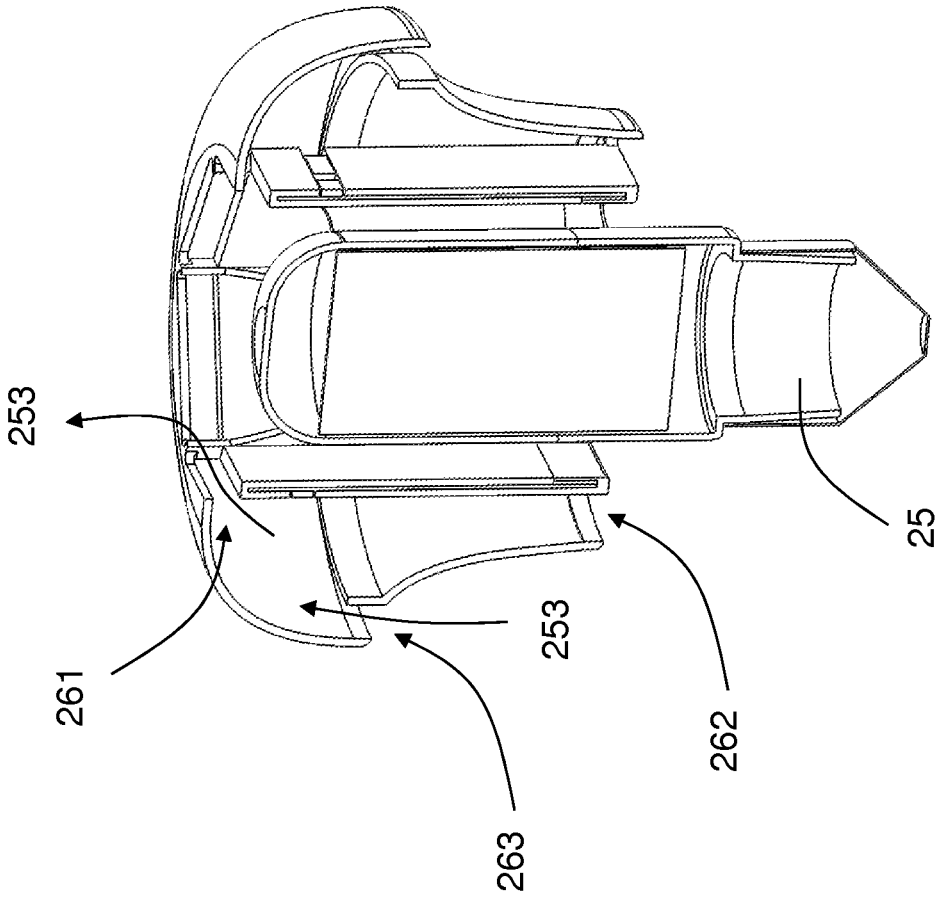


Fig.6

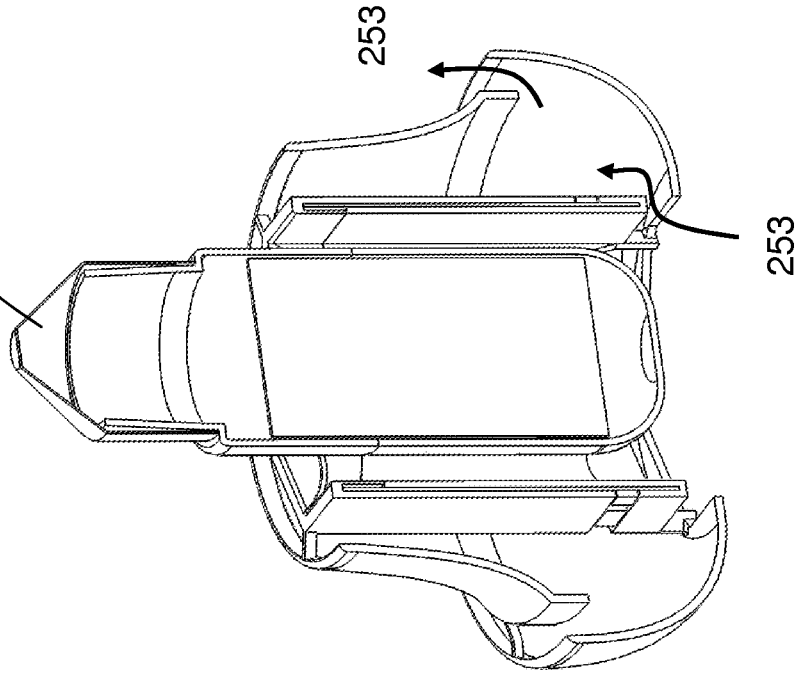


Fig.7

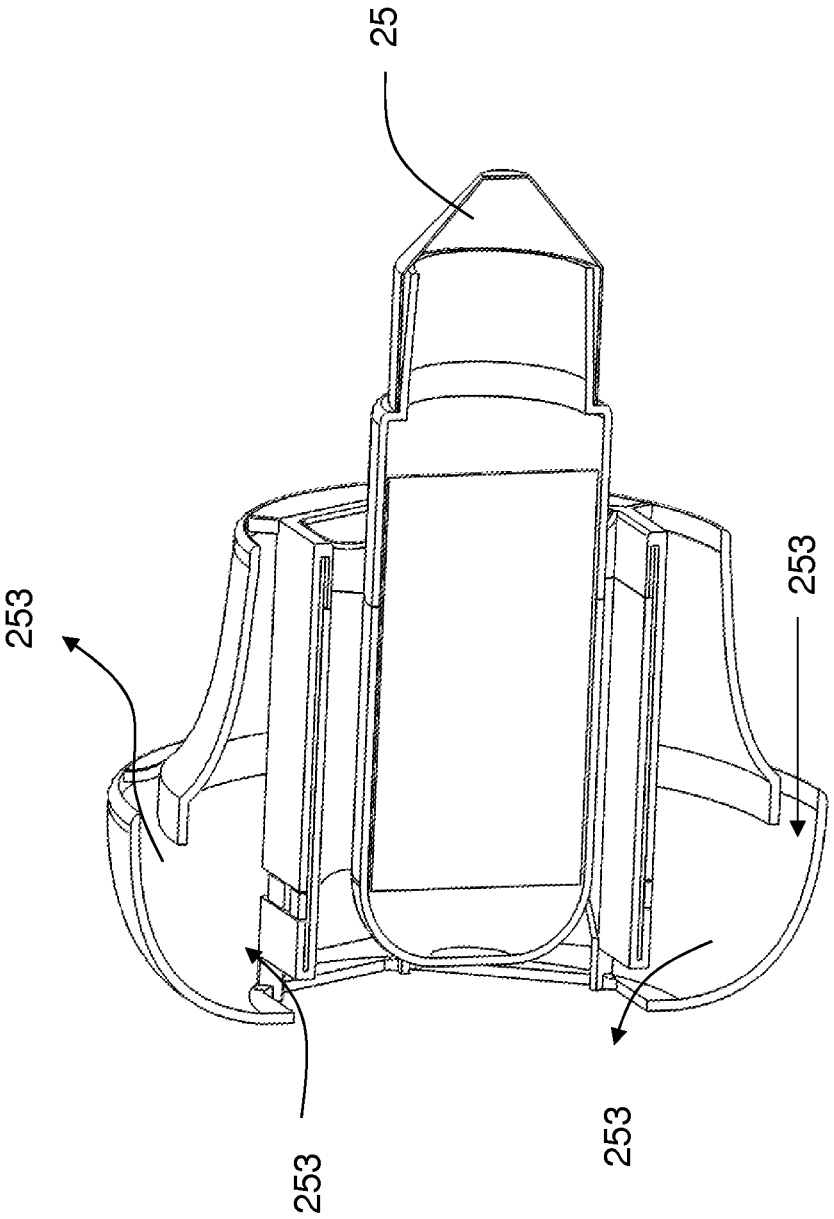
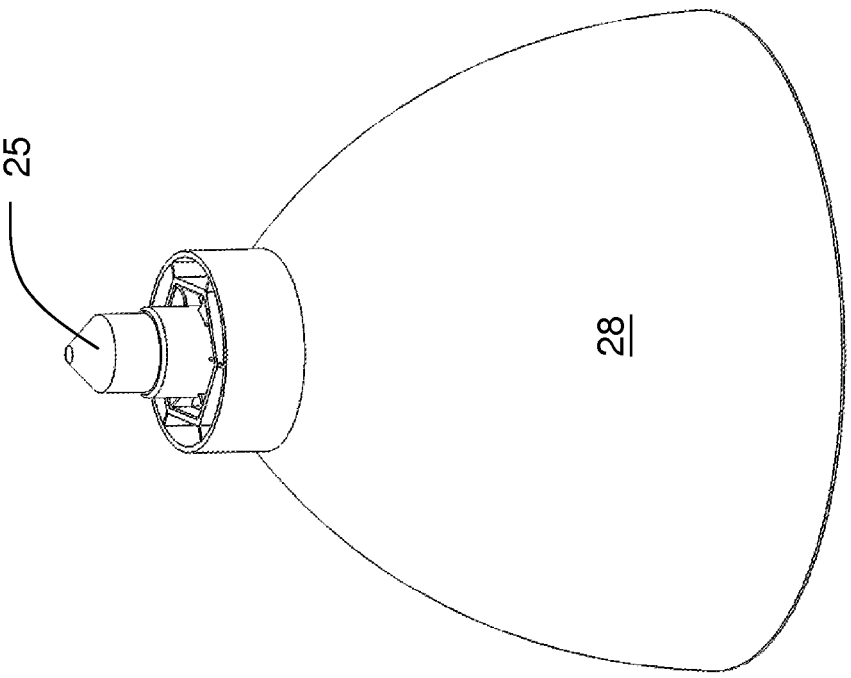


Fig.8



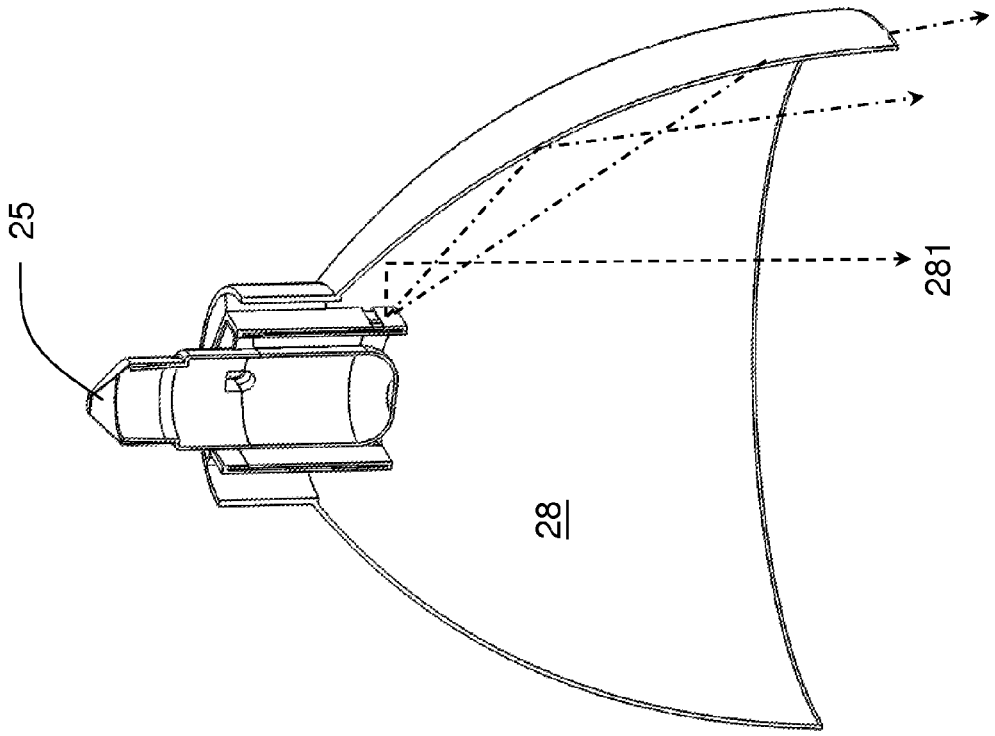


Fig.9

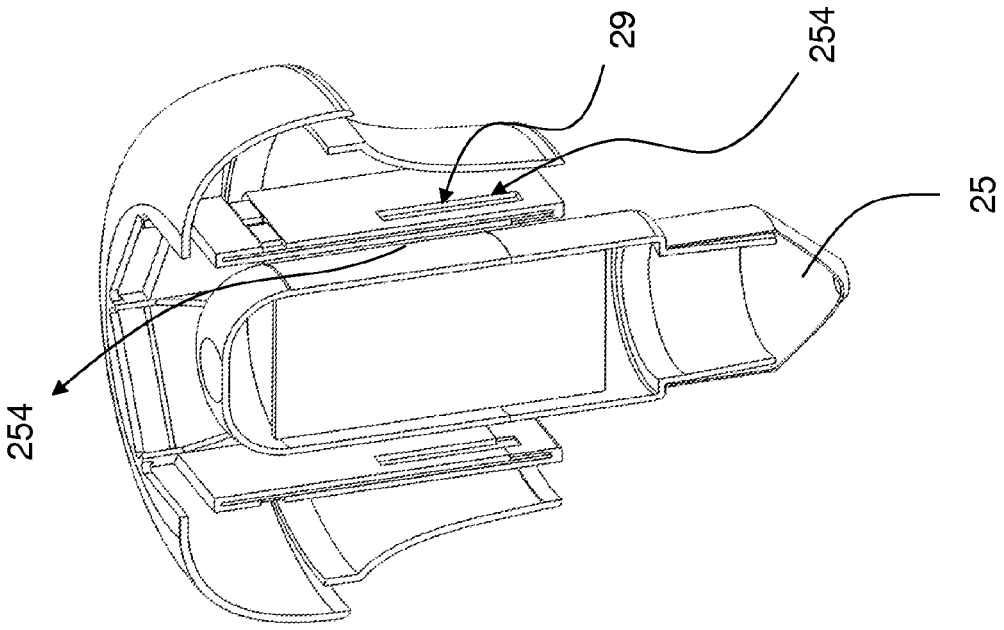


Fig.10

Fig. 11

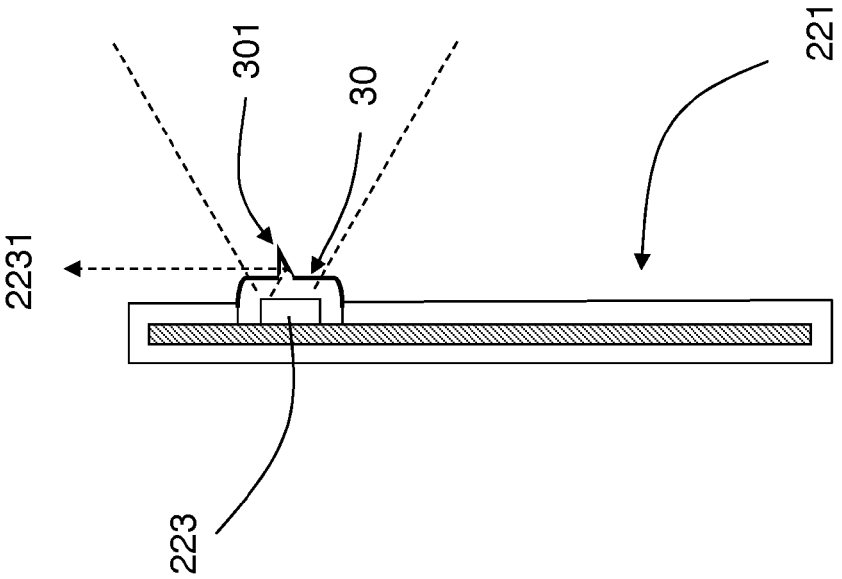


Fig.12

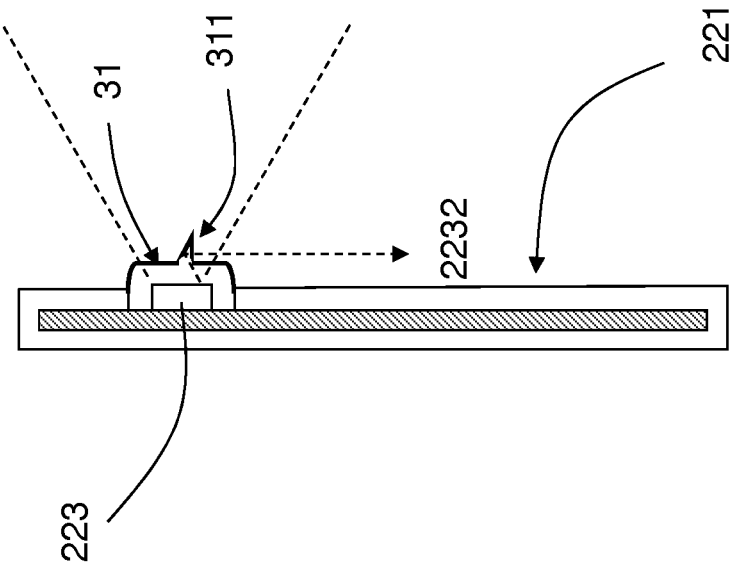


Fig.13

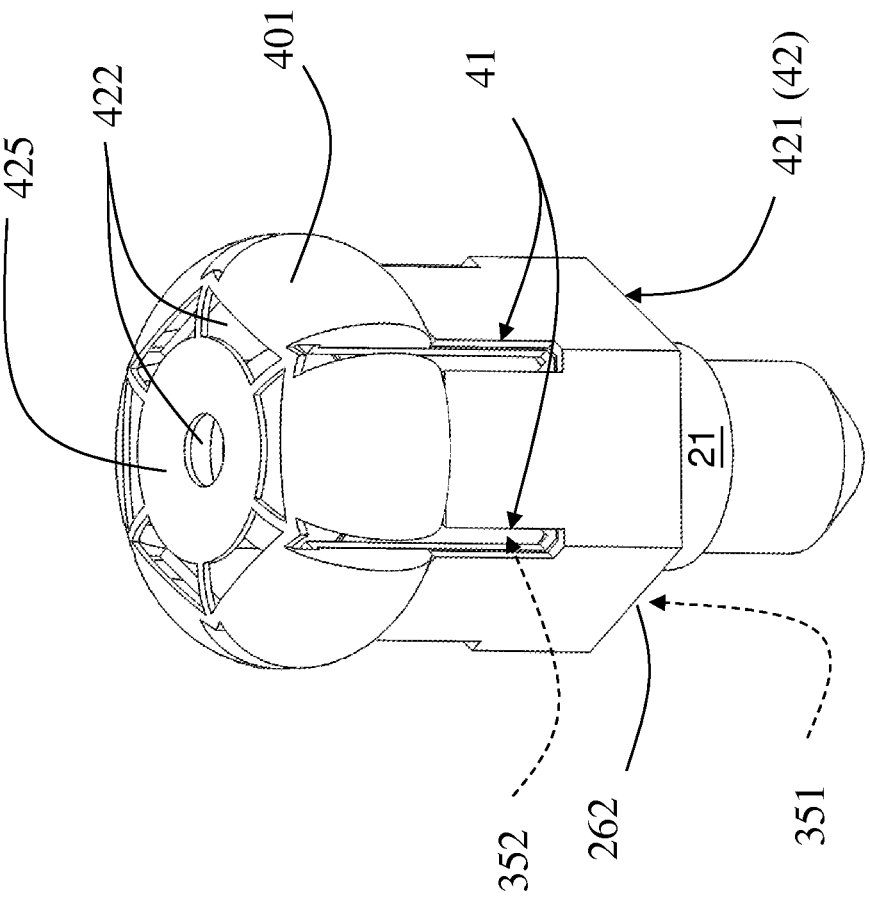


Fig.14

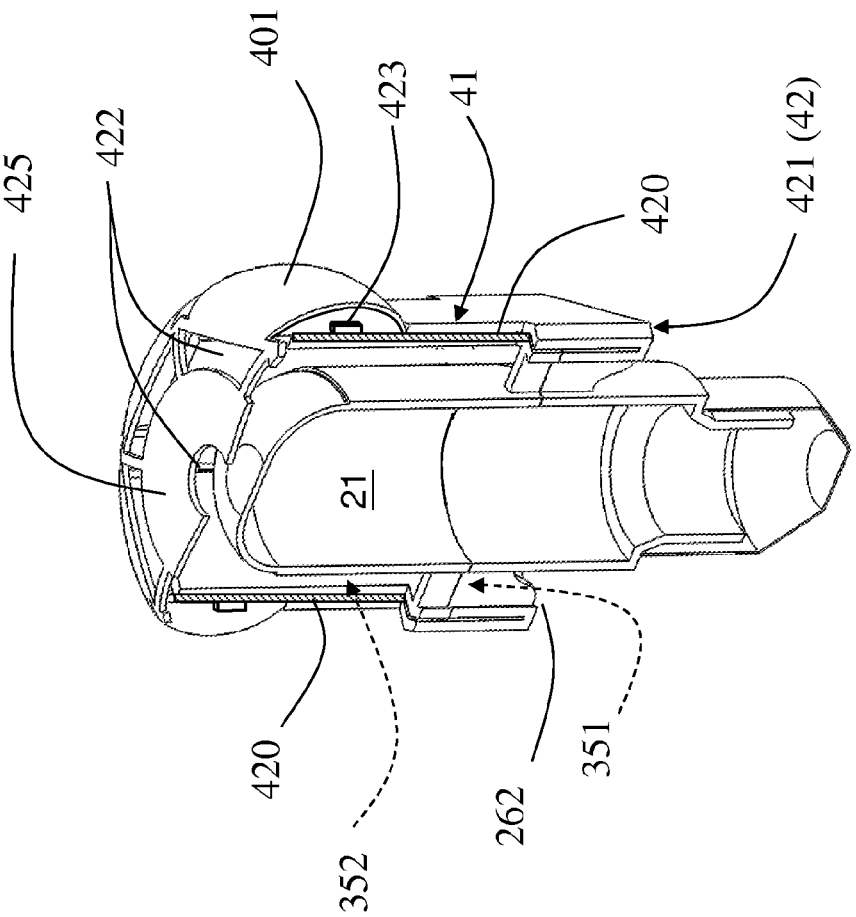


Fig.15B

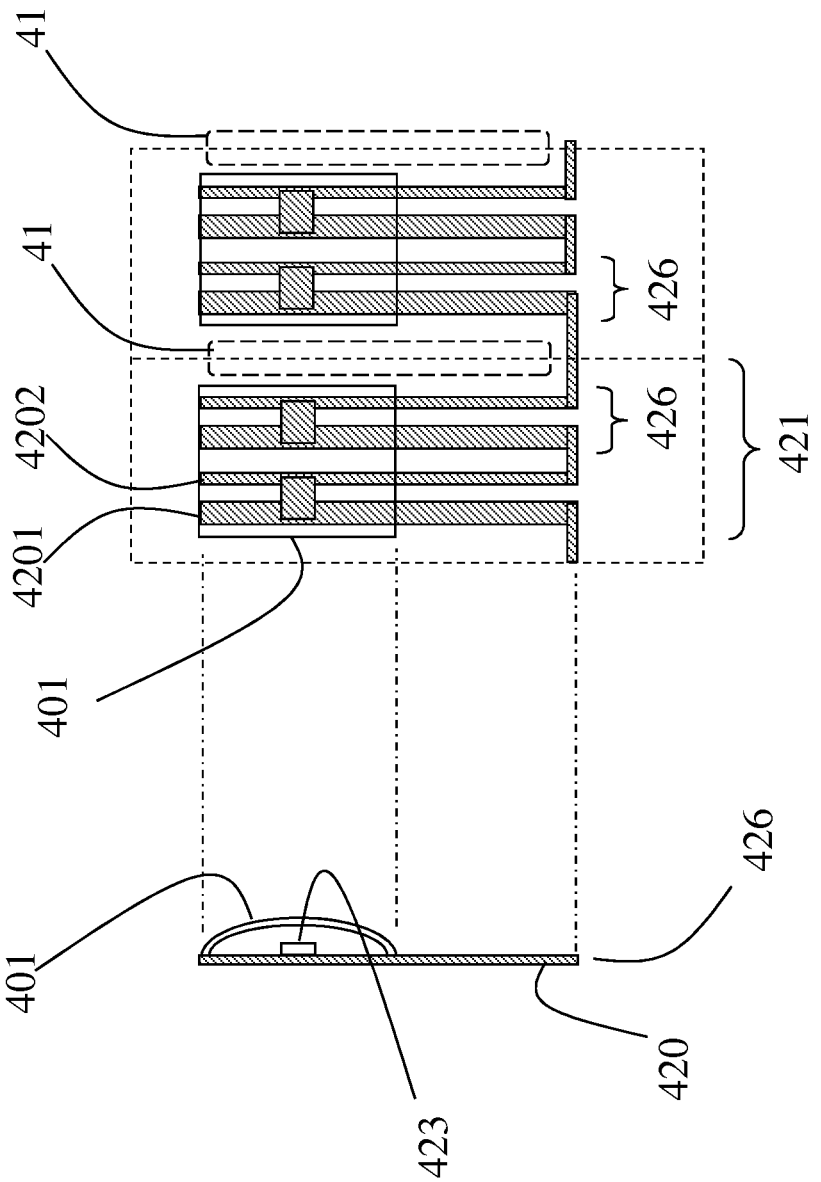


Fig.15A

Fig.16

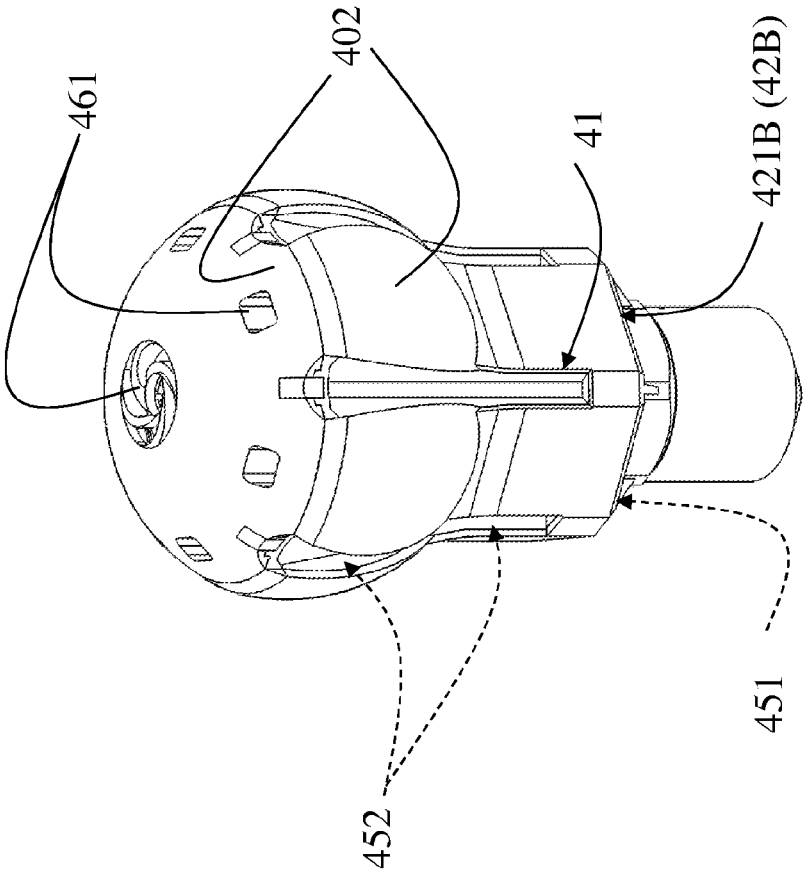


Fig.17

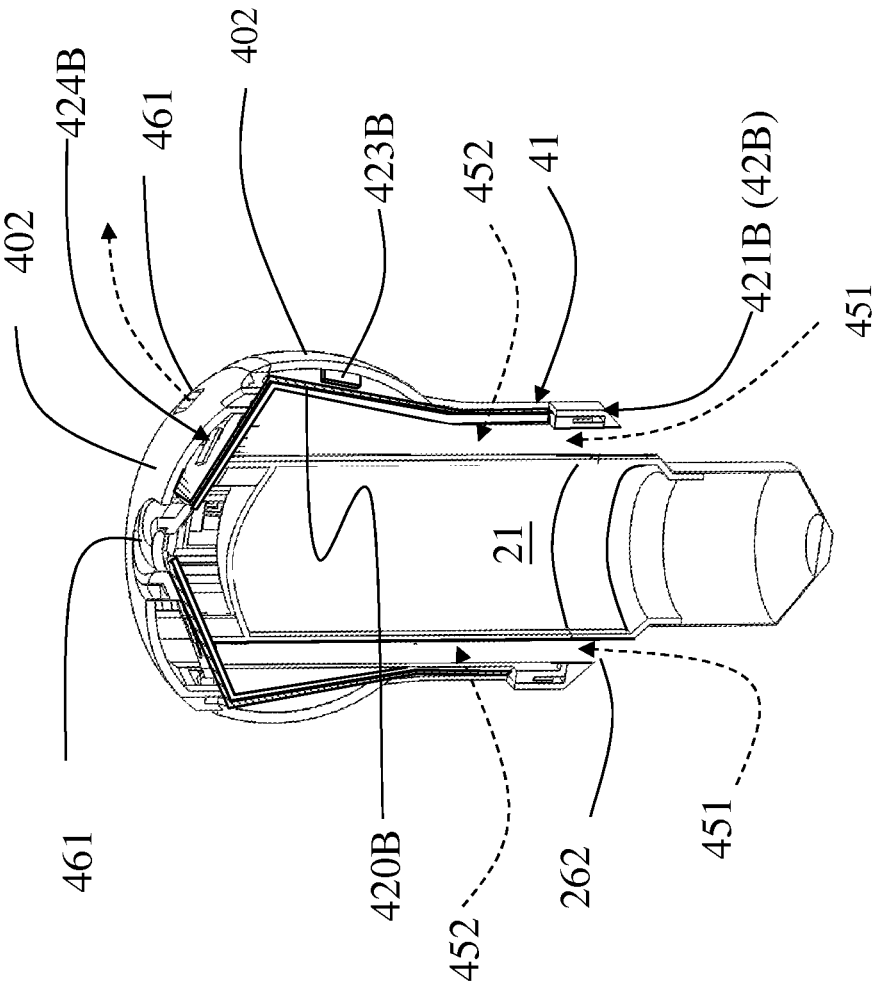

402
424B
461
402
423B
452
41
421B (42B)
451
21
461
420B
452
262
451

Fig.18B

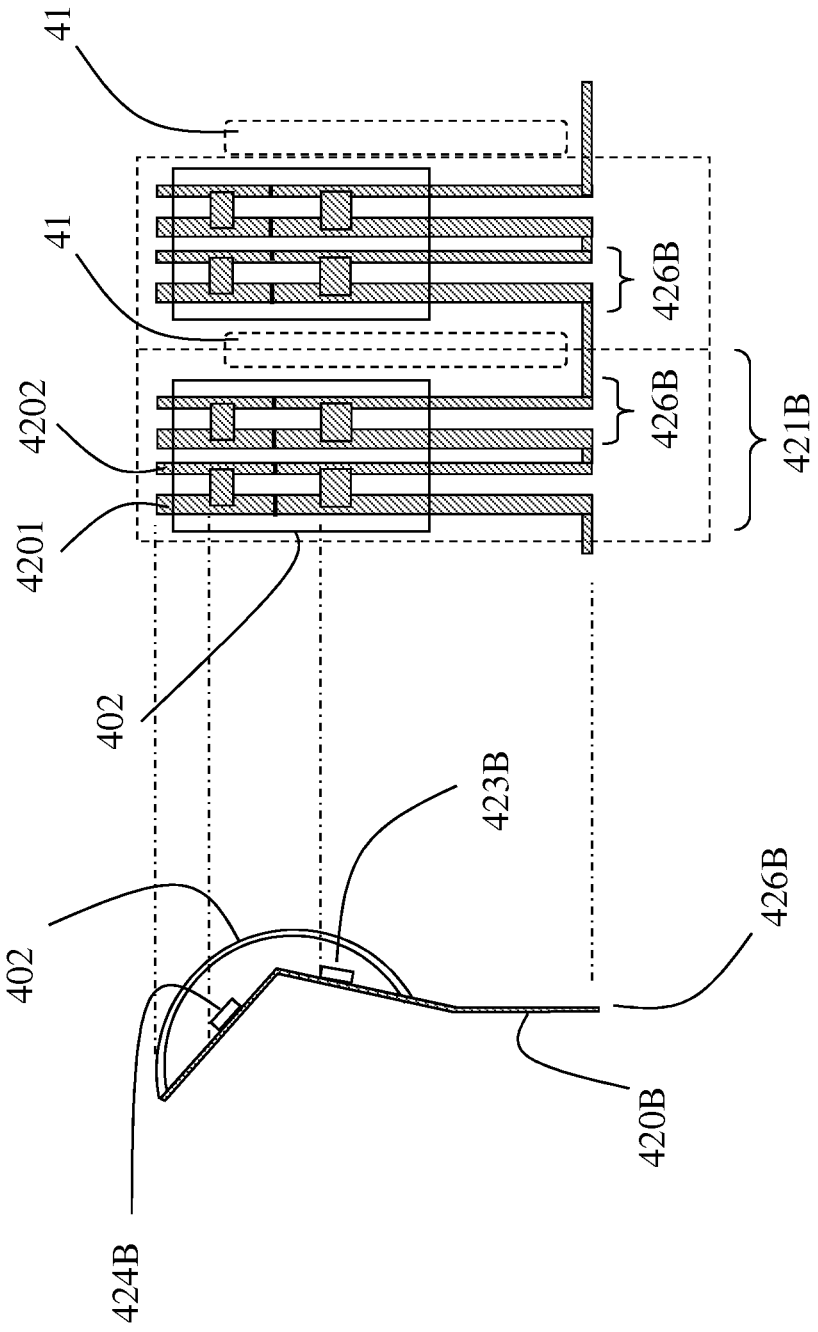


Fig.18A

AIR-COOLED LED LAMP BULB

This application is a continuation-in-part application of U.S. application Ser. No. 13/853,647 filed Mar. 29, 2013, the disclosure of which is incorporated by reference herein in its entirety.

BACKGROUND

1. Technical Field

The present invention relates to a lamp, especially an air cooling LED lamp which has air passages for natural cooling the lamp without using an electric fan.

2. Description of Related Art

FIG. **1** is a prior art

FIG. **1** shows a prior art, it discloses an LED lamp with an electric fan for cooling the lamp. The LED **5** is mounted on a support **4**. Cooling air **8** is guided through openings **11** in the lamp base **2** to electric fan **6** and blown out through a cavity **12** of the support **4** upward as discharge stream **9**. Cooling fins **13** for reinforced cooling of the support **4** are arranged in cavity **12**. By cooling the support **4**, the power demand of the LED lamp can be increased.

The deficiency of the prior art is to use an electric fan **6** for the cooling. Running of the electric fan **6** consumes electric energy. It is desired to develop a natural cooling system without using an electric fan so as to reduce electricity consumption.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a prior art

FIG. **2** is a first embodiment according to the present invention

FIG. **3**A is a section view of FIG. **2**

FIG. **3**B is a side view of the light unit of FIG. **3**A

FIG. **3**C is a front view of the metal strip of FIG. **3**B

FIG. **4** is a reversed position of the lamp of FIG. **3**A

FIG. **5** is a second embodiment according to the present invention

FIG. **6** is a reversed position of the lamp of FIG. **5**

FIG. **7** is a lateral position of the lamp of FIG. **5**

FIG. **8** is a modified embodiment according to the present invention

FIG. **9** is a section view of FIG. **8**

FIG. **10** is a modified lamp of FIG. **3**A

FIG. **11** is a modified light unit of FIG. **3**B

FIG. **12** is a further modified light unit of FIG. **3**B

FIG. **13** is a third embodiment according to the presentation invention.

FIG. **14** is a section view of FIG. **13**

FIG. **15**A is a side view of the light unit of FIG. **14**

FIG. **15**B is a front view of the light unit of FIG. **14**

FIG. **16** is a fourth embodiment according to the presentation invention.

FIG. **17** is a section view of FIG. **16**

FIG. **18**A is a side view of the light unit of FIG. **17**

FIG. **18**B is a front view of the light unit of FIG. **17**

DETAILED DESCRIPTION OF THE INVENTION

This invention uses air passages for cooling the led lamp without using any electric fan so that the present invention is a green product which reduces electric energy consumption.

FIG. **2** is a first embodiment according to the present invention

FIG. **2** shows an LED lamp, which has a central tube **21** for housing circuit board and other electronic elements. A circular light wall **22** encloses the central tube **21**. An air passage **251** is formed between the central tube **21** and the light wall **22** for a natural air-flow bottom up. A lamp base **25** is configured on a bottom of the central tube **21** for being able to mount the lamp to a conventional lamp socket. A top gap **261** is configured on a top of the light wall **22** for air flow. Top rib **272** is used for fixing the position between the light wall and the transparent dome **23**. A trumpet cup **24** is configured under the transparent dome **23**.

FIG. **3**A is a section view of FIG. **2**

FIG. **3**A is a section view of the lamp according to line AA' shown in FIG. **2**. The section view shows a central tube **21** having circuit board **201** and other electronic elements (not shown) inside. A circular light wall **22** is composed of a plurality of light unit **221** that are configured side by side. The circular light wall **22** surrounds the central tube **21**. Each of the light units **221** has a light source **223** mounted on a top end facing outward. A transparent dome **23** surrounds a top of the circular light wall **22** for modifying light beams of the light unit **221** before emitting. A central cavity **231** is configured on a top center of the transparent dome **23**.

A first air passage **251** is formed between the central tube **21** and the circular light wall **22** for air flow. A trumpet cup **24** is configured under the transparent dome **23**, surrounds lower part of the circular light wall **22**. A top gap **261** is configured between a top end of the transparent dome **23** and a top end of the circular light wall **22**. The top gap **261** communicates with the central cavity **231**. A bottom gap **262** is configured between a bottom of the circular light wall **22** and a bottom of the trumpet cup **24**. A second air passage **252** communicates between the top gap **261** and the bottom gap **262** for air flow.

An inner rib **271** is configured between the central tube **21** and the circular light wall **22** for fixing a position between the central tube **21** with reference to the circular light wall **22**. An outer rib **273** is configured between the circular light wall **22** and a trumpet cup **24** for fixing a position between the circular light wall **22** and the trumpet cup **24**. A top rib **272** is configured between a top end of the circular light wall **22** and a top end of the transparent dome **23** for fixing a position between the circular light wall **22** and the transparent dome **23**.

FIG. **3**B is a side view of the light unit of FIG. **3**A. FIG. **3**B shows that the light source **223**, which includes an LED, is mounted on a top of the metal strip **220**. A front side protection layer **224** coated on a front side of the metal strip **220** except an area for the light source **223** to mount. A back side protection layer **222** is coated on a back side of the metal strip **220**.

FIG. **3**C is a front view of the metal strip of FIG. **3**B

FIG. **3**C shows the structure of a metal strip **220** of the light unit **221**. A pair of metal strips **2201**, **2202** is parallel configured. The light source **223** is straddled on a top of the metal strips **2201**, **2202**.

FIG. **4** is a reversed position of the lamp of FIG. **3**A

FIG. **4** shows when the lamp of FIG. **3**A is configured in a reversed position, the first air passage **251** and the second air passage **252** still work for the air flow cooling bottom up.

FIG. **5** is a second embodiment according to the present invention

FIG. **5** is a modified lamp of FIG. **3**A. FIG. **5** shows that a side gap **263** is configured between a bottom end of the transparent dome **23** and a top end of the trumpet cup **24**. A third air passage **253** communicates between the side gap **263** with the top gap **261** for air flow.

FIG. **6** is a reversed position of the lamp of FIG. **5**

FIG. **6** shows when the lamp of FIG. **5** is configured in a reversed position, the third air passage **253** still work for the air flow bottom up.

FIG. **7** is a lateral position of the lamp of FIG. **5**

FIG. **7** shows when the lamp of FIG. **5** is configured in a lateral position, the third air passage **253** still work for the air flow bottom up.

FIG. **8** is a modified embodiment according to the present invention

FIG. **8** shows that a reflection cup **28** is prepared to cover the lamp as a lampshade for modifying the light direction of the light source **223** before emitting.

FIG. **9** is a section view of FIG. **8**

FIG. **9** shows the direction of the light beams **281** have been modified by the inner wall of the reflection cup **28** before the light beams exiting the lamp.

FIG. **10** is a modified lamp of FIG. **3**A

FIG. **10** shows that a slot **29** is configured passing through a lower portion of the light unit. A further air passage **254** is formed for air flow to enhance the cooling efficiency.

FIG. **11** is a modified light unit of FIG. **3**B

FIG. **11** shows that a lens **30** is configured in front of the light source **223** of the light unit **221** for compensating the light beams upward **2231**. The lens **30** has a triangle extension **301** for reflecting light beam upward.

FIG. **12** is a further modified light unit of FIG. **3**B

FIG. **12** shows that a lens **31** is configured in front of the light source **223** of the light unit **221** for compensating the light beams downward **2232**. The lens has a triangle extension **311** for reflecting light beam downward.

FIG. **13** is a third embodiment according to the presentation invention.

FIG. **13** shows that an air cooling LED lamp has a central tube **21** surrounded by a circular light wall **42**. A top frame **425** connects the circular light wall **42** on top. A plurality of top opening **422** is made in the top frame **425** as an air outlet. A plurality bottom gap **262** is configured between a bottom of the central tube **21** and a bottom of the circular light wall **42**. A first air passage **351** is configured between the central tube **21** and the circular light wall **42**. The first air passage **351** communicates the top opening **422** and the bottom gap **262**. The bottom gap **262** functions as a first air inlet. A plurality of side opening **41** is configured passing through the circular light wall **42**. Each of the side opening **41** functions as a second air inlet. The opening **41** communicates with the first air passage **351**. A second air passage **352** is formed between the side opening **41** and the top opening **422** for air flow. FIG. **13** shows that a six-facet polygon as an example, more or less number of light facet can be designed as the polygon light wall according to different application. The side opening **41** is made in a position between two neighboring light facets **421**, in other words, the side opening **41** is made in the boundary or corner of neighboring light facet **421**.

FIG. **14** is a section view of FIG. **13**

FIG. **14** shows that a metal strip **420** is partially sandwiched by protection layers in each light facet **421**. An LED chip **423** is mounted on a top of the metal strip **420** to emit light beams facing outward to illuminate peripheral surrounding. A plurality of side opening **41** is made passing through the light wall **42**. The side opening **41** is configured in a boundary or corner of neighboring light facets **421** of the polygon light wall **42**. FIG. **14** shows that a side opening **41** is made beside the metal strip **420** in a section view. The protection cover **401** is configured in front of the LED chip **423**. The first air passage **351** is configured between the bottom gap **262** and the top opening **422**. The second air passage **352** is configured between the side opening **41** and the top opening **422**.

FIG. **15**A is a side view of the light unit of FIG. **14**

FIG. **15**A shows that the light unit **426** has a LED chip **423** mounted on a top end of the metal strip **420**, and a protection cover **401** is configured in front of the LED chip **423**.

FIG. **15**B is a front view of the light unit of FIG. **14**

FIG. **15**B shows that each light unit **426** has a pair of metal strips **4201**, **4202**. The LED chip **423** straddles on the two metal strips. The side opening **41** is made in a location between two neighboring light unit **426**. Referring to FIG. **13** in view of FIG. **15**B, each light facet **421** has two light units **426** inside; but this is an example only for describing the concept of the instant application; more or less light unit **426** can also be used in a single light facet **421**.

FIG. **16** is a fourth embodiment according to the presentation invention.

In comparison with FIG. **13**, which shows a flat top frame **425** with a plurality of openings **422**, the design of FIG. **16** shows a dome top protection cover **402** with a plurality of top openings **461**.

FIG. **17** is a section view of FIG. **16**

FIG. **17** shows that a curved metal strip **420**B is partially sandwiched by protection layers in each light facet **421**B. The curved metal strip **420**B has a first facet facing peripheral oblique downward and a second facet facing peripheral oblique upward. A first LED chip **423**B is mounted on the first facet in a position obliquely downward so as to emit light beams to illuminate obliquely downward. A second LED chip **424**B is mounted on the second facet in a position obliquely upward so as to emit light beams to illuminate obliquely upward. The remaining structure is similar to the corresponding structure of the design of FIG. **13**.

A first air passage **451** is configured between the central tube **21** and the circular light wall **42**B. The first air passage **451** communicates the top opening **461** and the bottom gap **262**. The bottom gap **262** functions as a first air inlet. A plurality of side opening **41** is configured passing through the circular light wall **42**B. Each of the side opening **41** functions as a second air inlet. The opening **41** communicates with the first air passage **451**. A second air passage **452** is formed between the side opening **41** and the top opening **461** for air flow.

FIG. **18**A is a side view of the light unit of FIG. **17**

FIG. **18**A shows that a first LED chip **423**B is mounted on the first facet of the curved metal strip **420**B, facing obliquely downward; and a second LED chip **424**B is mounted on the second facet of the curved metal strip **420**B, facing obliquely upward. A protection cover **402** is configured in front of both LED chips **423**B and **424**B.

FIG. **18**B is a front view of the light unit of FIG. **17**

FIG. **18**B shows that each light unit **426**B has a pair of metal strips **4201**, **4202**. Each of the first LED chip **423**B and the second LED chip **424**B, straddles on the two metal strips. The side opening **41** is made between two neighboring light unit **426**B. Referring to FIG. **16** in viewing of FIG. **18**B, each light facet **421** has two light units **426**B inside; but this is an example only for describing the concept of the instant application; more or less light unit **426** can also be used in a single light facet **421**.

While several embodiments have been described by way of example, it will be apparent to those skilled in the art that various modifications may be configured without departing from the spirit of the present invention. Such modifications are all within the scope of the present invention, as defined by the appended claims.

What is claimed is:

1. An air-cooled lamp bulb, comprising:

a central tube;

a circular light wall formed by a plurality of light units surrounding the central tube and emitting light beams in a direction away from the central tube;

a top frame supporting the circular light wall on top;

a top opening formed in the top frame;

a bottom gap formed between a bottom of the central tube and a bottom of the circular light wall; and

a first air passage formed between the central tube and the circular light wall, and connecting the top opening and the bottom gap for allowing air flow through the air-cooled lamp bulb.

2. The air-cooled lamp bulb as claimed in claim **1**, further comprising:

a side opening passing through the circular light wall; and

a second air passage formed between the side opening and the top opening for allowing air flow through the air-cooled lamp bulb.

3. The air-cooled lamp bulb as claimed in claim **2**, wherein

the circular light wall comprises a plurality of polygon light facets, and

the side opening is formed in a position between two facets among the plurality of polygon light facets.

4. The air-cooled lamp bulb as claimed in claim **2**, wherein

the circular light wall comprises a plurality of polygon light facets, and

the side opening is configured in a boundary of neighboring facet among the plurality of polygon light facets.

5. The air-cooled lamp bulb as claimed in claim **2**, wherein

the circular light wall comprises a plurality of polygon light facets, and

the side opening is configured in a corner of a facet among the plurality of polygon light facets.

6. An air-cooled lamp bulb, comprising:

a central tube;

a circular light wall formed by a curve light unit surrounding the central tube, the curved light unit having a first facet facing obliquely downward and a second facet facing obliquely upward;

a dome top protection cover;

a top opening formed on a top of the dome top protection cover;

a bottom gap formed between a bottom of the central tube and a bottom of the circular light wall; and

a first air passage formed between the central tube and the circular light wall, and connecting the bottom gap and the top opening for allowing air flow through the air-cooled lamp bulb.

7. The air-cooled lamp bulb as claimed in claim **6**, further comprising:

a side opening passing through the circular light wall; and

a second air passage formed between the side opening and the top opening for allowing air flow through the air-cooled lamp bulb.

8. The air-cooled lamp bulb as claimed in claim **6**, wherein

the circular light wall comprises a plurality of polygon light facets, and

the side opening is formed in a position between two facets among the plurality of polygon light facets.

9. The air-cooled lamp bulb as claimed in claim **6**, wherein

the circular light wall comprises a plurality of polygon light facets, and

the side opening is configured in a boundary of neighboring facets among the plurality of polygon light facets.

10. The air-cooled lamp bulb as claimed in claim **6**, wherein

the circular light wall comprises a plurality of polygon light facets, and

the side opening is configured in a corner of a facet among the plurality of polygon light facets.

11. The air-cooled lamp bulb as claimed in claim **6**, further comprising:

a first LED chip mounted on the first facet and emitting a light beam obliquely downward.

12. The air-cooled lamp bulb as claimed in claim **11**, further comprising:

a second LED chip mounted on the second facet and emitting a light beam obliquely upward.

13. The air-cooled lamp bulb as claimed in claim **12**, further comprising:

a protection cover formed in front of the first LED chip and the second LED chip.

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